Nycomed Amersham Licenses LBNL MRI Technology

Enhanced Specificity Expected to Improve Medical Imaging

Nycomed Amersham, a world leader in diagnostic medical imaging, has signed a licensing agreement with LBNL for use of magnetic resonance imaging technology developed in the research groups of Alex Pines and Thomas Budinger. The LBNL team had developed techniques that increase the specificity of magnetic resonance imaging (MRI) through the injection of laser-polarized noble gases. Nycomed plans to use the technology to enhance its MRI instruments for the generation of high-resolution images of specific physiological structures.

To date, the application of nuclear magnetic resonance (NMR) and MRI techniques to the study of physiological processes has been limited by the lack of required sensitivity. Although used widely in research and in a variety of applications, NMR and MRI, which detect nuclear “spins,” are normally relatively insensitive techniques; under ordinary conditions, their signals come from only 1-10 atoms out of every million in the sample under study. The other atoms in the sample have spins which are equally divided between “up” and “down” and thus cancel each other. Techniques pioneered at Princeton and further developed at LBNL, have increased the sensitivity of these techniques through the use of inert noble gases which are laser-polarized through exposure to an intense beam of circularly polarized laser light. The “hyperpolarized” gases are then delivered to the target molecules, organisms, and materials. The hyperpolarization increases the number of uncanceled spins and therefore the magnetic resonance signal. In early medical imaging applications of this technique, the hyperpolarized xenon or helium gas was introduced to patients by inhalation. This enabled scientists to generate high-resolution images of the lungs by “observing” the hyperpolarized helium gas present in the open airways. Organs, such as the brain, were also studied by imaging the hyperpolarized xenon transported to and absorbed by those tissues. However, with inhalation it is difficult to target structures for imaging: in the case of helium, the gas remains in the lungs and in the case of xenon, the gas is distributed broadly throughout the entire body by the bloodstream.

The LBNL team solved this problem by developing new methods to introduce hyperpolarized noble gases into specific biological systems (MSD Highlight 97-4). In one case, hyperpolarized Xe is dissolved in a biocompatible solution and administered directly into the organ in question by injection (see figure). The solution can also be tailored to transport the xenon preferentially to a target organ, for example, the brain (with saline solution injected into the carotid artery) or tissue/fat structures such as the liver (with lipid solution injected intramuscularly). To improve targetting even further, a former LBNL postdoctoral fellow, Angelo Bifone, now at the Institute for Cancer Research in London, has incorporated bubbles of hyperpolarized xenon into liposomes, hollow structures whose surfaces can be coated with molecules that attach specifically to the surfaces of tissues of interest.

“Nycomed Amersham’s history is one of identifying and pioneering innovation in the world of medical imaging agents,” said John Padfield, Chief Executive Officer of Nycomed’s Imaging Division. “The licensing of the LBNL technology in combination with Nycomed Amersham Imaging’s technology and world leadership in commercialization, brings together a technology package that has the potential to revolutionize the way physicians image organ function, and, ultimately, the way they diagnose illnesses.” Nycomed Amersham Imaging has annual sales of over $1.8 billion and over 8,000 employees worldwide.

Alex Pines (510 642-1220) Materials Sciences Division (510 486-4755); Thomas Budinger, (510) 486-5435, Life Sciences Division, (510 486-6671); E. O. Lawrence Berkeley National Laboratory.